# SOLAR DECATHLON 2022

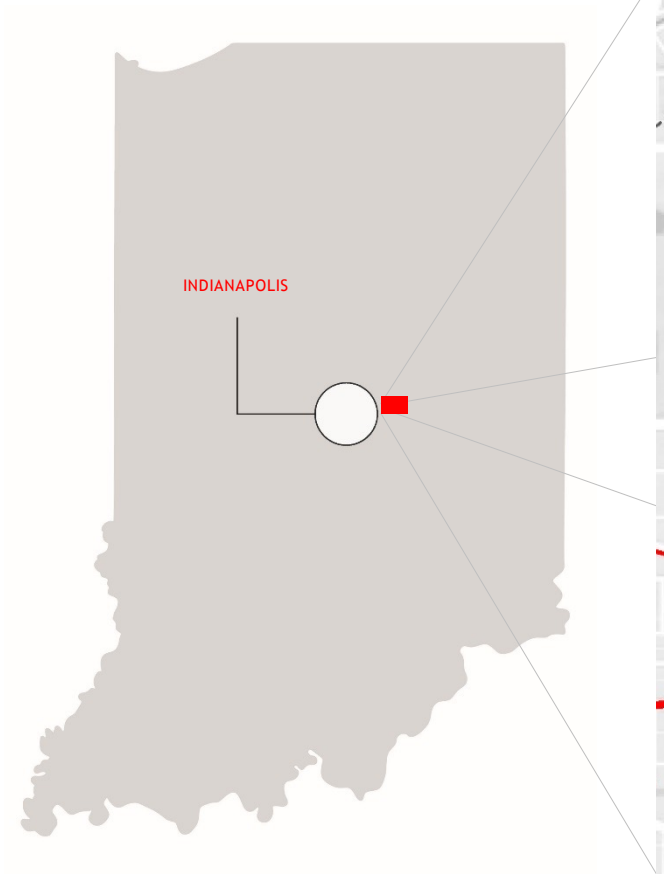
## PROJECT XERO | BSU ATTACHED HOUSING

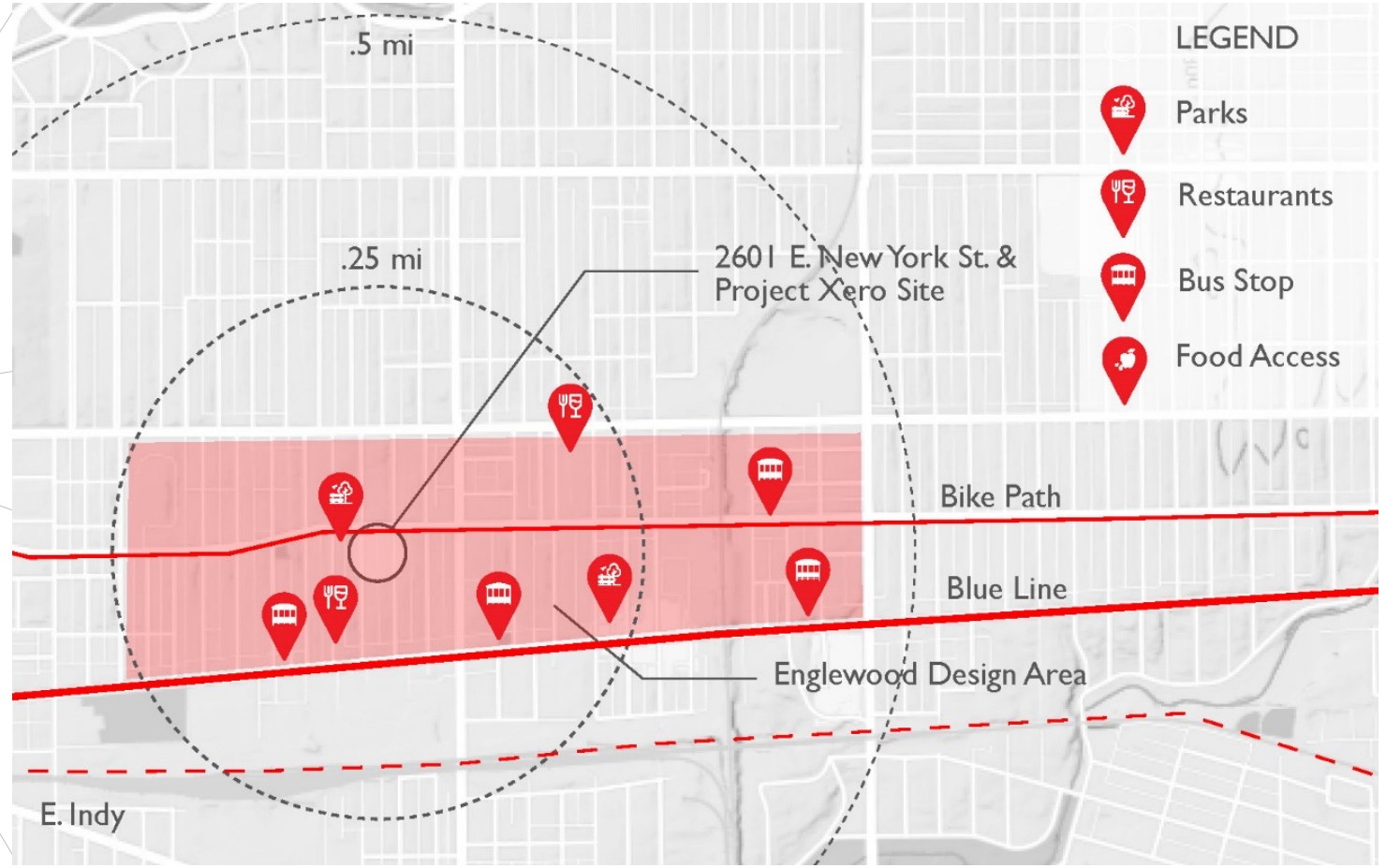
TYLER RENSCHEN
CHARLIE DAVIS
ZEELYN STUTZ
DILLON REDDING

XERO

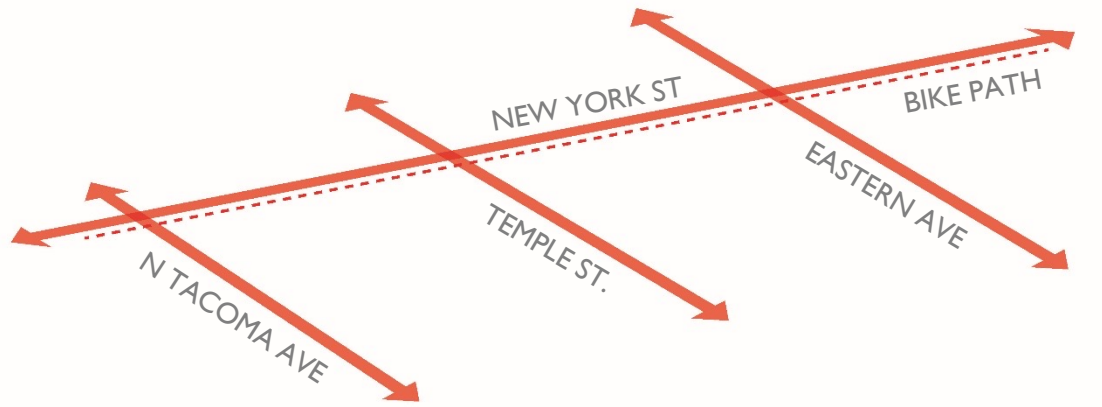
# SITE



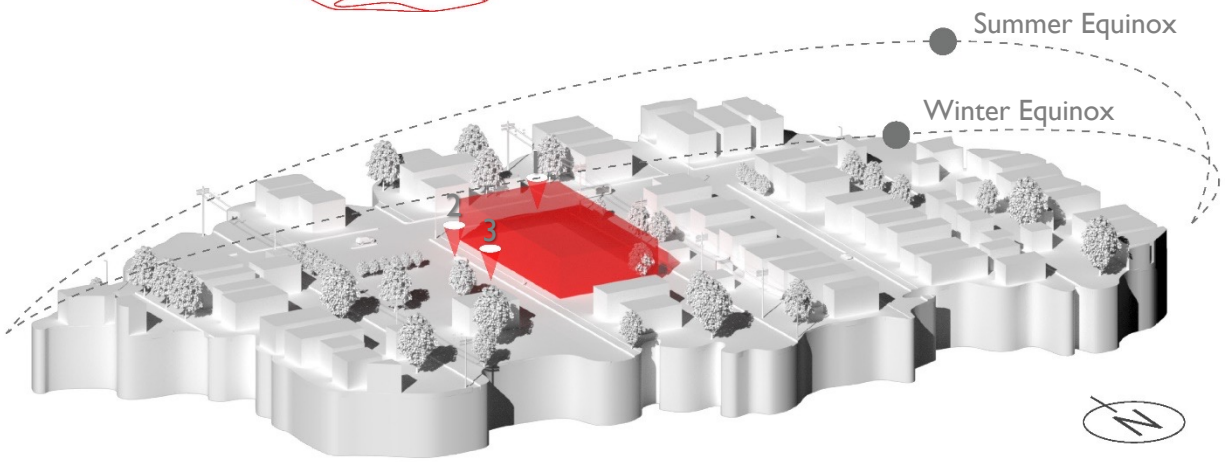

INDIANAPOLIS


.5 mi
.25 mi
2601 E. New York St. &
Project Xero Site
LEGEND
Parks
Restaurants
Bus Stop
Food Access
Bike Path
Blue Line
Englewood Design Area
E. Indy

# SITE

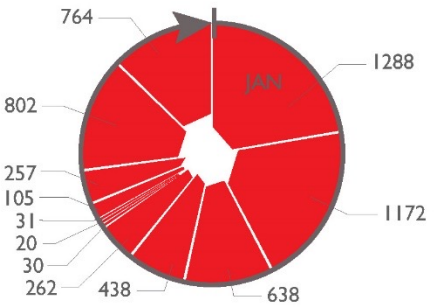






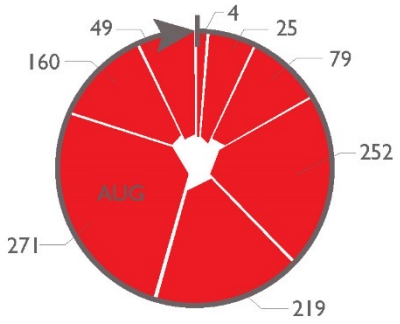

1

AVE 5850 HDD



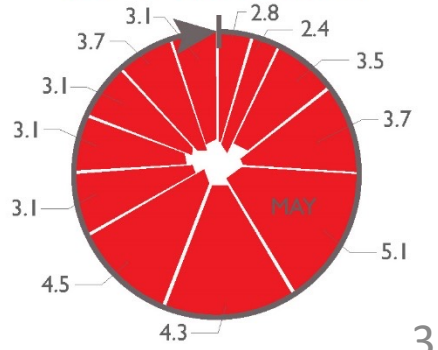

2

AVE 1054 CDD




3

AVE 46" PRECIPITATION



# PROJECT INTRO



## ENGLEWOOD CDC GOALS

LIVEABILITY

OPPORTUNITY

VITALITY

EDUCATION

## STUDIO XERO RESPONSE

Unit sizes perfect for families up to 5

ADA accessible 1st floors maximizing visitability

Direct access to bike path on New York St.

Deeply integrated community spaces throughout complex

1 block from blue line transit route

Attached 24/7 work and collaboration space

**52%** Percent of Englewood population with some high school education

**0:24** Mean travel time to work every day.

**40k** Near east side current population

**23K** Median annual income of Englewood community member

ENGLEWOOD
COMMUNITY DEVELOPMENT CORPORATION

# MARKET ANALYSIS + TARGET



| | AVE. ENGLEWOOD HOME | PROJECT XERO |
|---|---|---|
| OCCUPANTS/UNIT | 2 ½ | 2-5 |
| UNIT SIZE | 1,600ft$^2$ | 1,200-2,000 ft$^2$ |
| UTILITY COST | $300 | $60 |
| CONSTRUCTION COST | $200/ft$^2$ | $195/ft$^2$ |
| MORTGAGE COST | $600 / month | $500 / month |
| OWNERSHIP TYPE | Owner Occupied | Rent to Own * |

* Englewood CDC is currently developing a 40 residential unit rent to own housing program in the surrounding neighborhood.

# ARCHITECTURE



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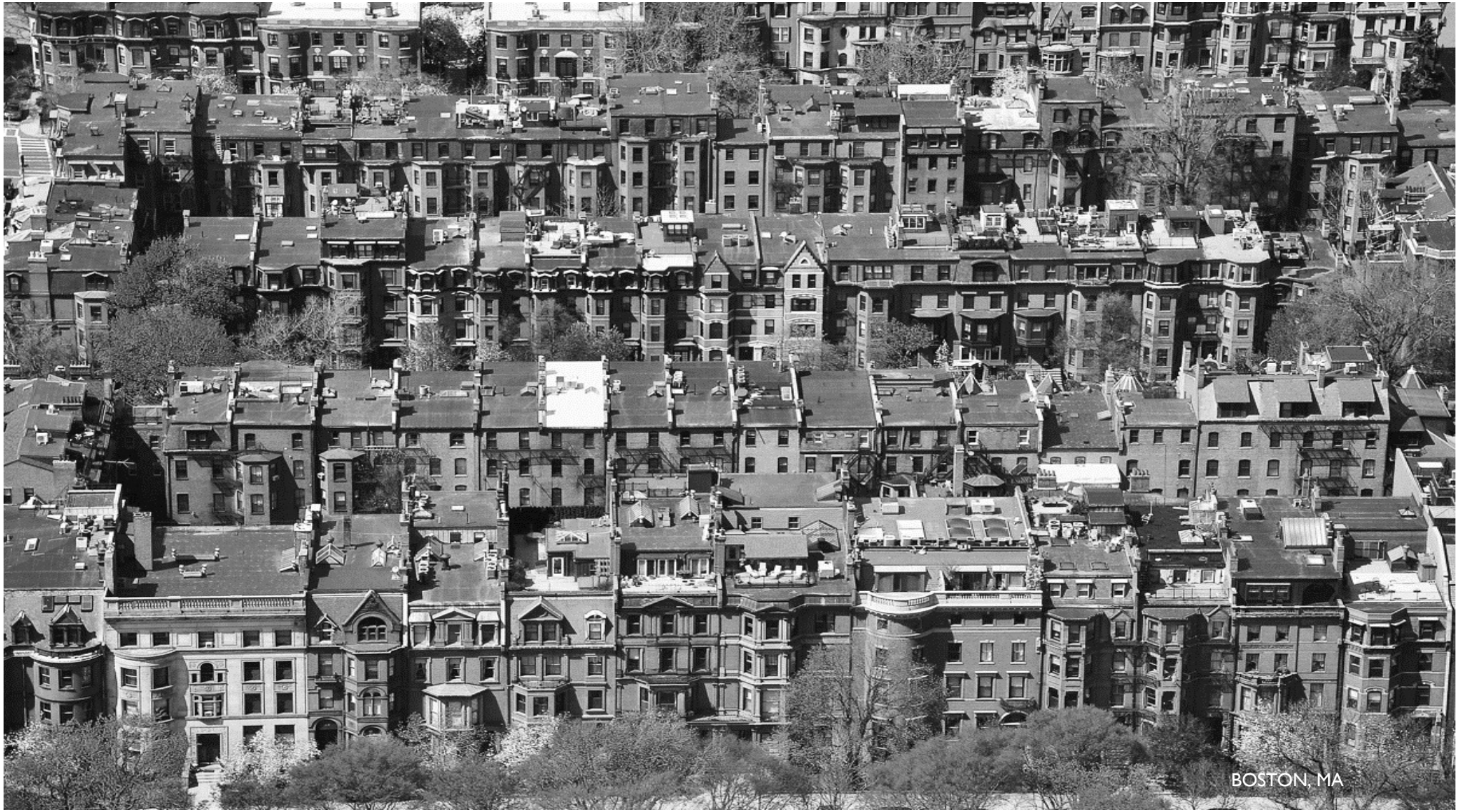
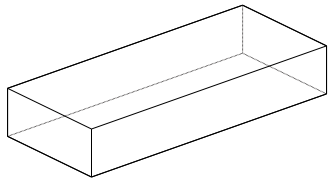


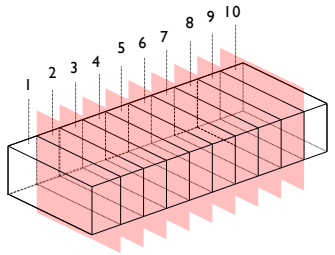
BOSTON, MA

# ARCHITECTURE

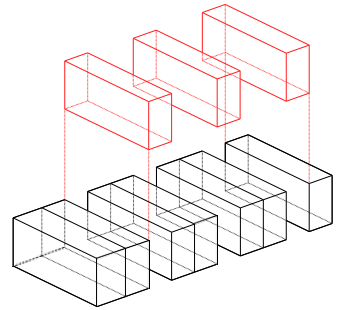




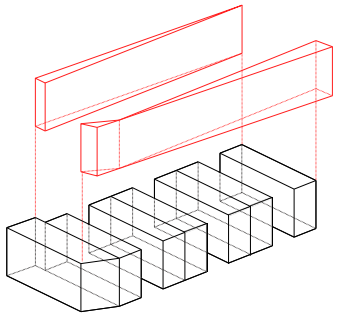
**BLOCK**
Scaled 3D massing of site buildable area



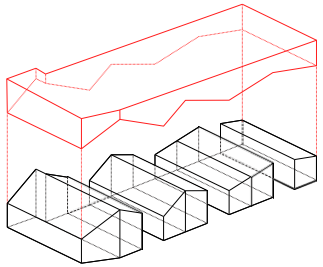

**VERTICAL SPLIT**
After researching unit sizing, divide buildable area into potential units.



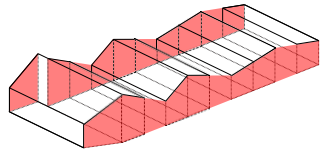
**SUBTRACT**
Divide units to allow for interstitial courtyards & increase daylighting in units



**TAPER**
Angle frontal facades for sightlines & distinction between public/private



**ROOF PITCH**
Subtract roof pitch with consideration towards PV collection & uniqueness



**CONTINUOUS FAÇADE**
Unify separate buildings with continuous rainscreen, façade.

# ARCHITECTURE



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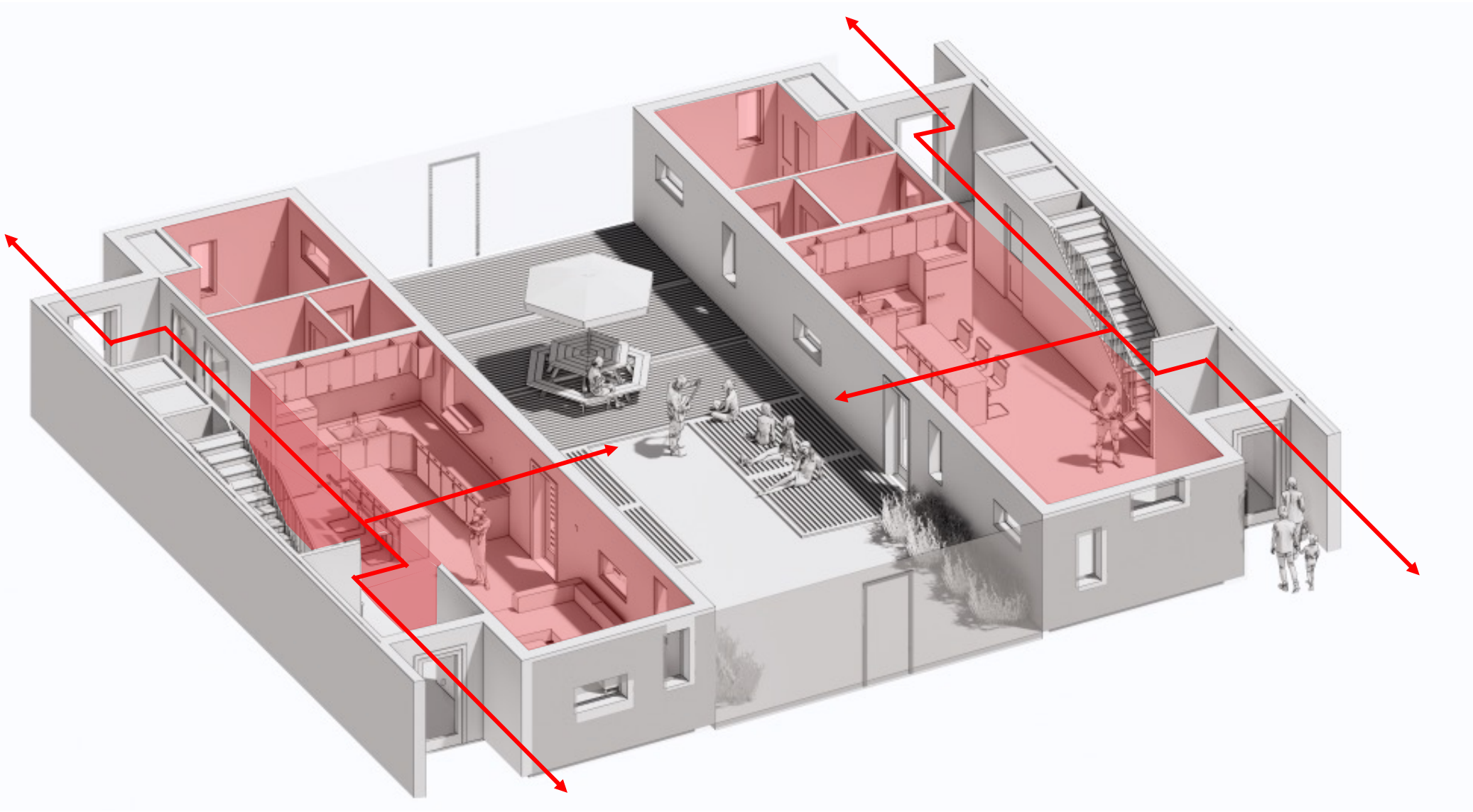
# OCCUPANT EXPERIENCE





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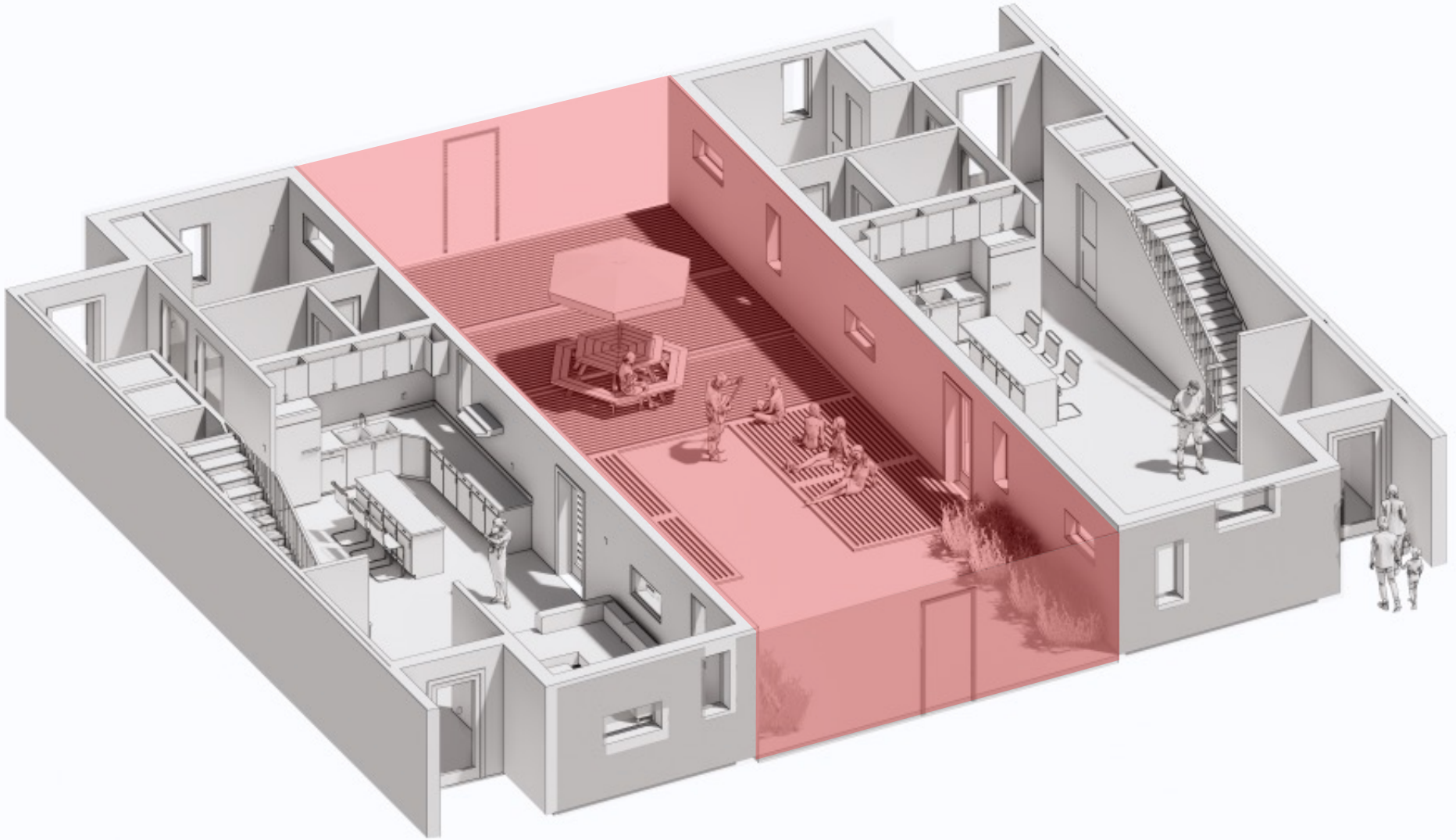

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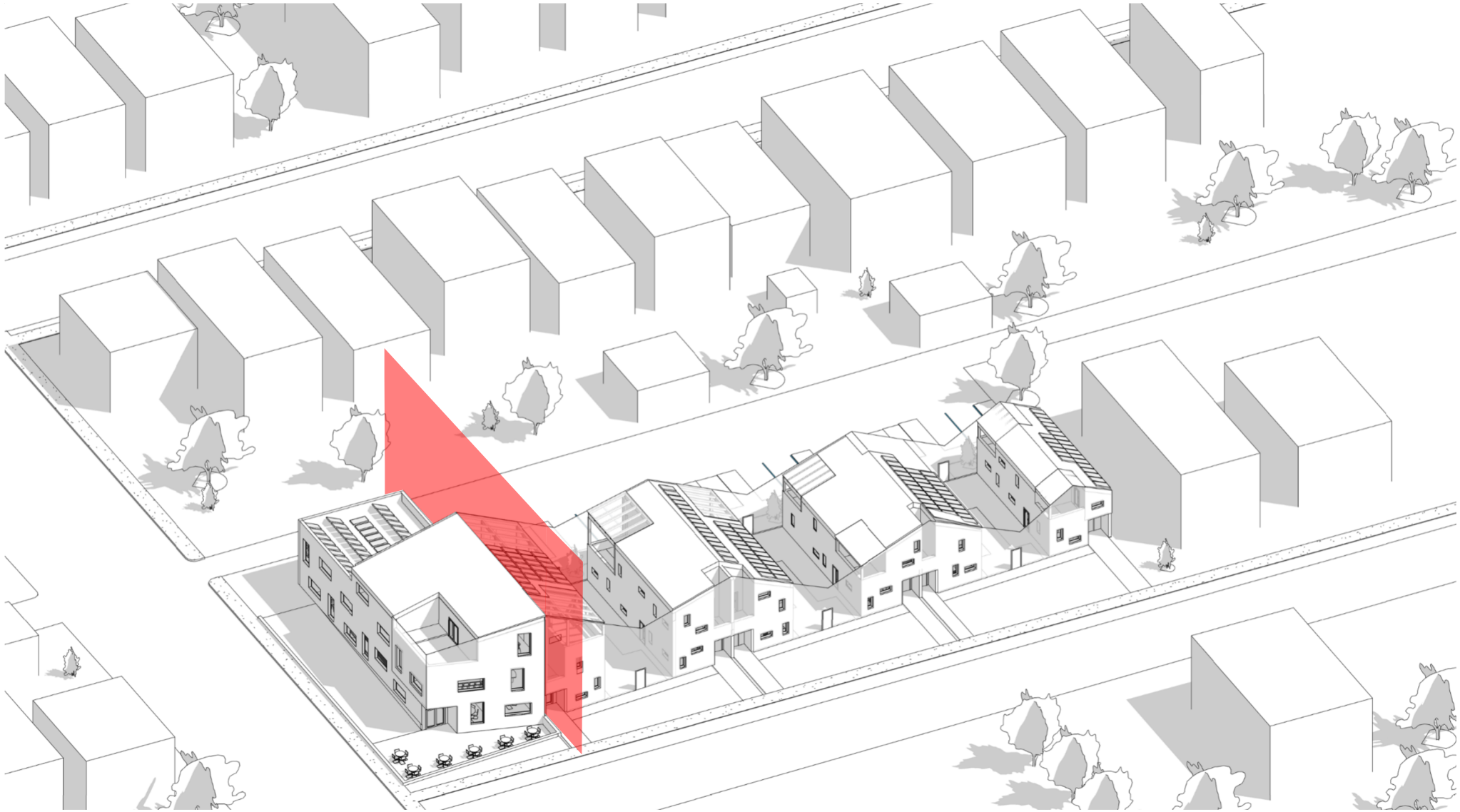
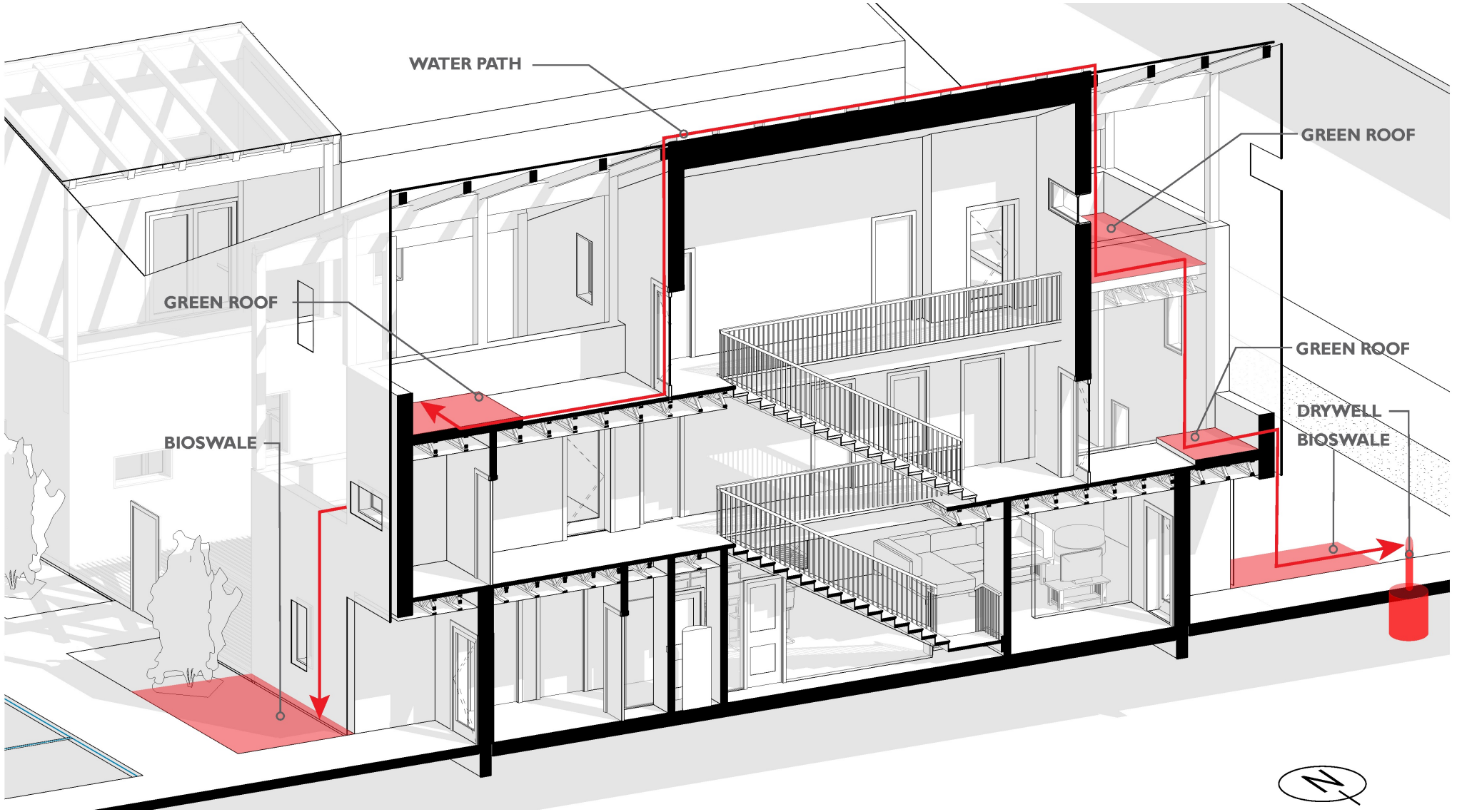
# ARCHITECTURE





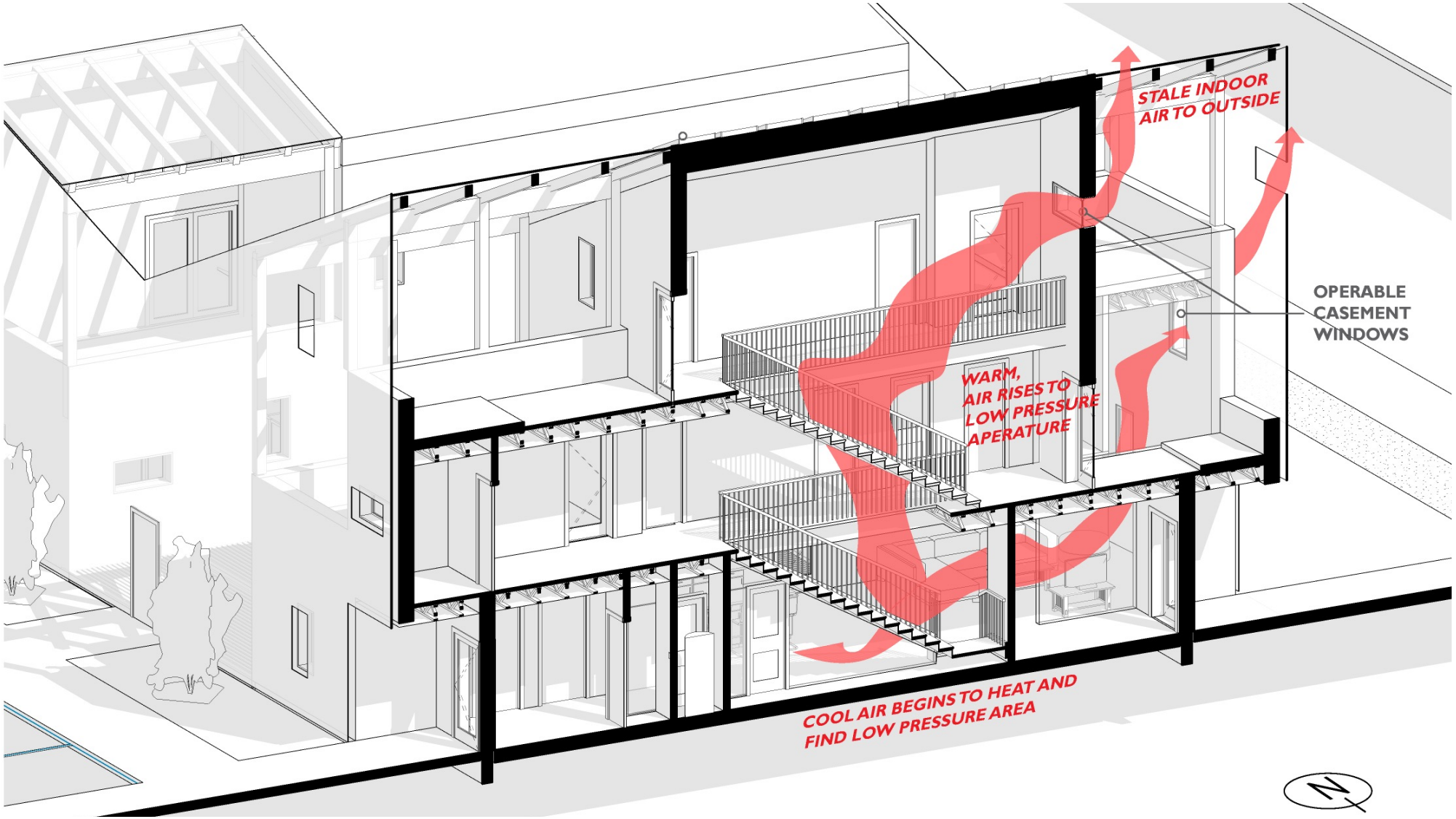
# DURABILITY & RESILIENCE





# INTEGRATED PERFORMANCE





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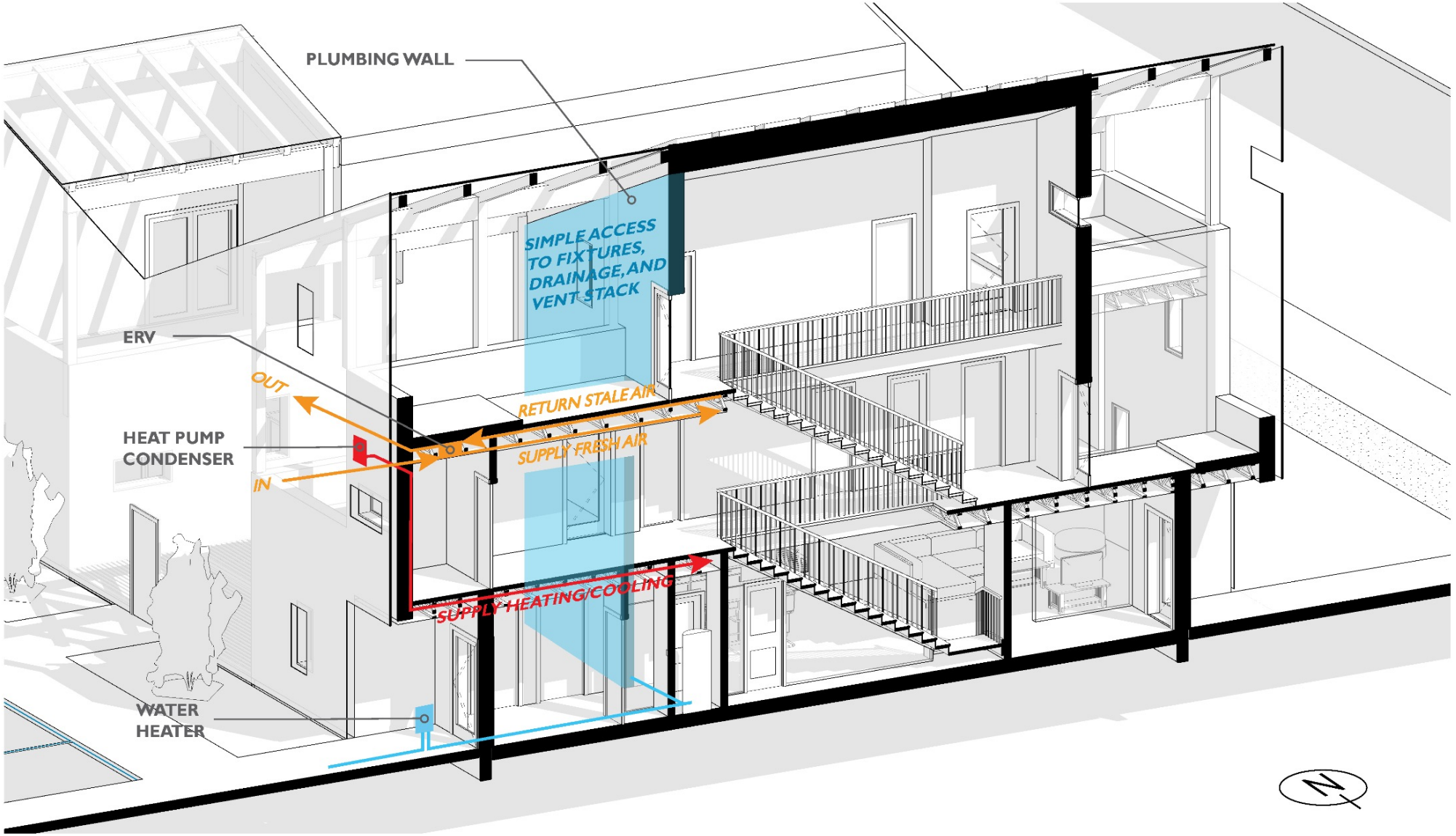

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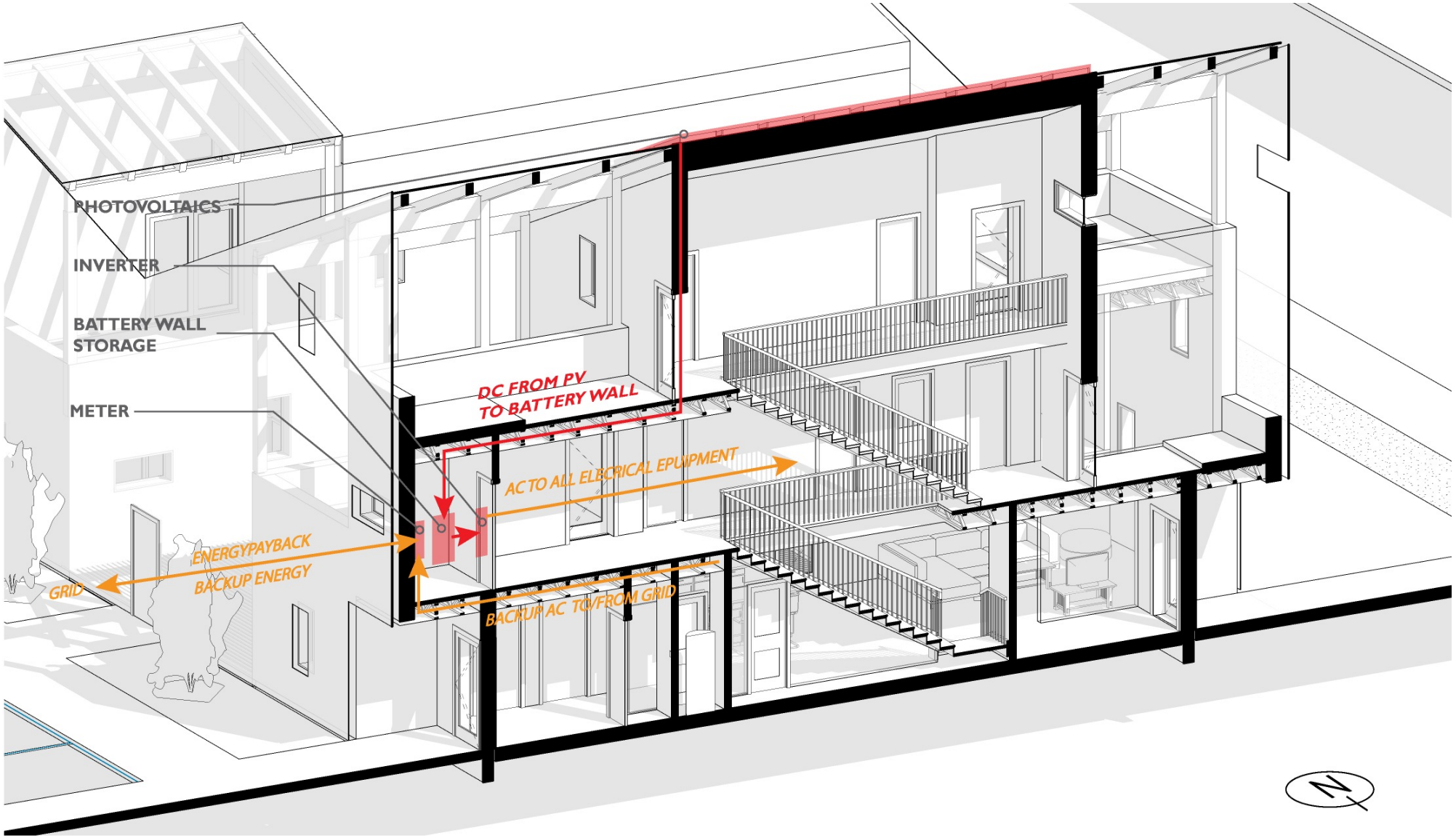


# ENERGY PERFORMANCE



| SYSTEM | UNIT 1 | UNIT 2 | UNIT 3 | UNIT 4 | UNIT 5 | UNIT 6 | CO-WORK |
|---|---|---|---|---|---|---|---|
| Panasonic Evervolt | 32 PANELS | 40 PANELS | 32 PANELS | 32 PANELS | 32 PANELS | 40 PANELS | 80 PANELS |
| Tesla Power Wall 11 | 1 BATT | 1 BATT | 1 BATT | 1 BATT | 1 BATT | 1 BATT | 3 BATT |

| UNIT | SQFT | EUI | HERS | PV ARRAY YEILD (kwh/YEAR) | EUI – POST PV |
|---|---|---|---|---|---|
| 1 | 1200 | 33.66 | 34 | 17700 | -7.3 |
| 2 | 1300 | 21.52 | 33 | 11100 | -6.3 |
| 3 | 1350 | 22.13 | 33 | 11100 | -6.8 |
| 4 | 1600 | 20.77 | 33 | 11000 | -8.4 |
| 5 | 1800 | 19.9 | 33 | 11000 | -9 |
| 6 | 2000 | 34.5 | 35 | 17700 | -6.72 |
| CO-WORK | 6633 | 25.6 | 36 | 63720 | -1.3 |

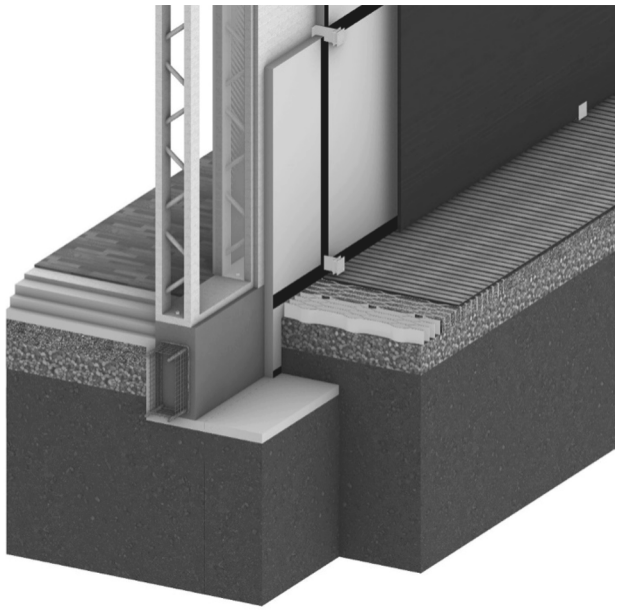
EUI BASELINE GOAL : 25

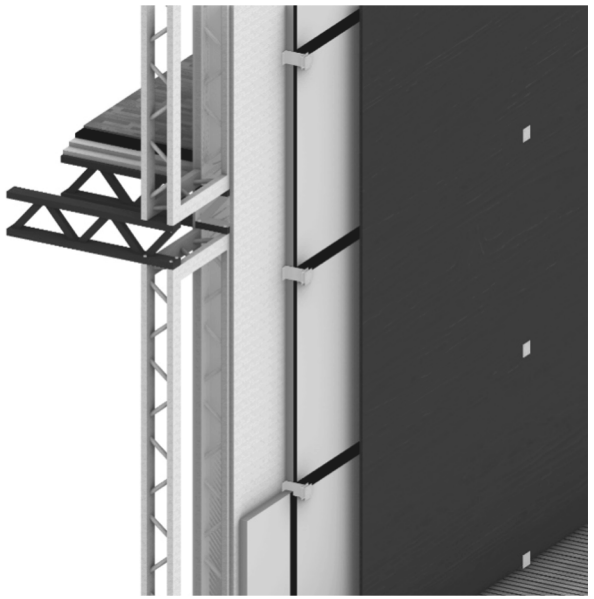
EUI AFTER ONLY PASSIVE DESIGN INTERVENTIONS : 26

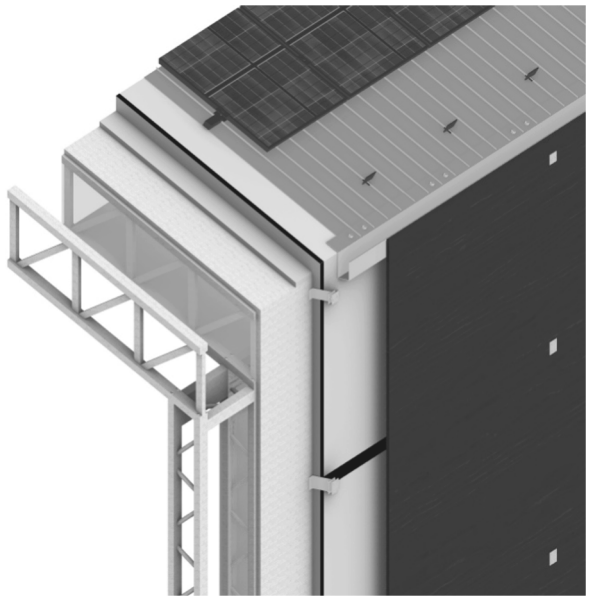
EUI AFTER PHOTOVOLTAICS : -6

# ENGINEERING









# ENGINEERING



## Heat Resistance [[R = T2-T1]/Q]

Interior air film ---------- R-.68
5/8" gypsum bo. ---------- R-0.6
8" t-stud w/ blown cellulose
insulation ---------- R-28
¾" plywood ---------- R-0.6
2" rigid poly-iso insulation ---- R-14
2" air gap ---------- R- ~~2~~
1" plywood ---------- R-1.2
Exterior air film ---------- R-.17

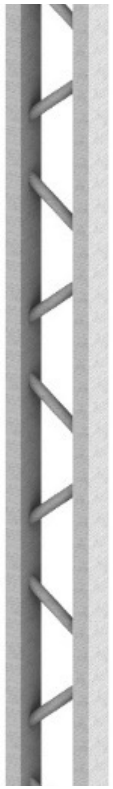
**Total = R-45.25**

## Framing Factor [F = As/At]

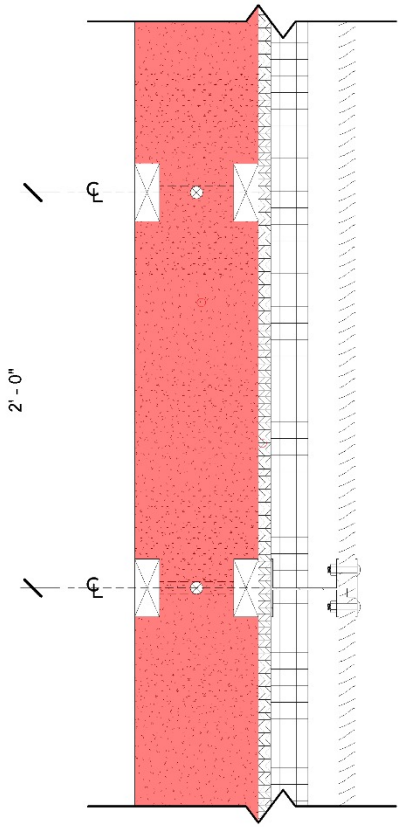
As = 11.52 $in^2$
Ai = 168.48 $in^2$
At = 180 $in^2$

11.52/180 = .064 = **6.4%**
9.4[typ.] – 6.4[t-stud] = 3.0
3.0/9.4 = **32% savings**

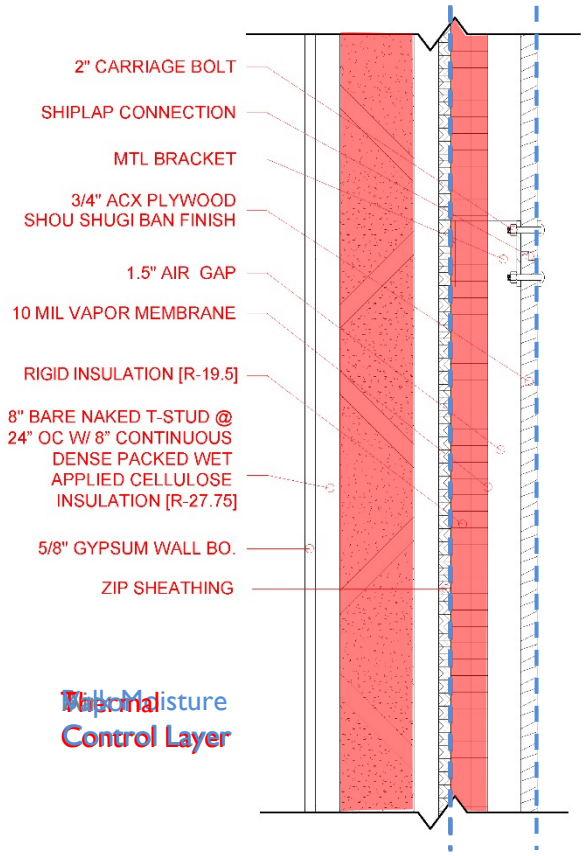
## T-Stud Detail



## Exterior Wall Plan Detail




## Exterior Wall Section Detail




R-values and U-factors were determined by (or influenced by) the PHIUS Core Prescriptive requirements

# ENGINEERING



### Heat Resistance [[R = T2-T1]/Q]

Interior air film ---------- R-.68
½" wood flooring---------- R-0.6
1" plywood ---------- R-0.8
8" rigid poly-iso insulation ----- R-26

**Total = R-28.08**

### Concrete Reduction

Typ. strip footing ---------- 273 cf
Typ. Foundation wall --------- 3,276 cf
Shallow foundation wall ----- 1,274 cf

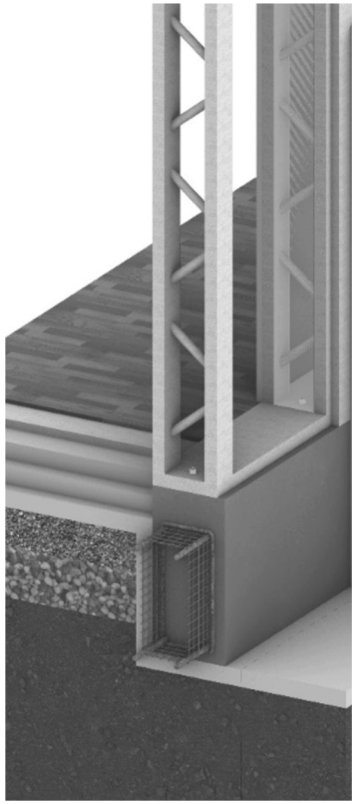
**Total Foundation & Concrete Savings = 2,275 cf OR 64%**

Typ. concrete slab ---------- 6,649 cf
Concrete free slab ---------- 0 cf

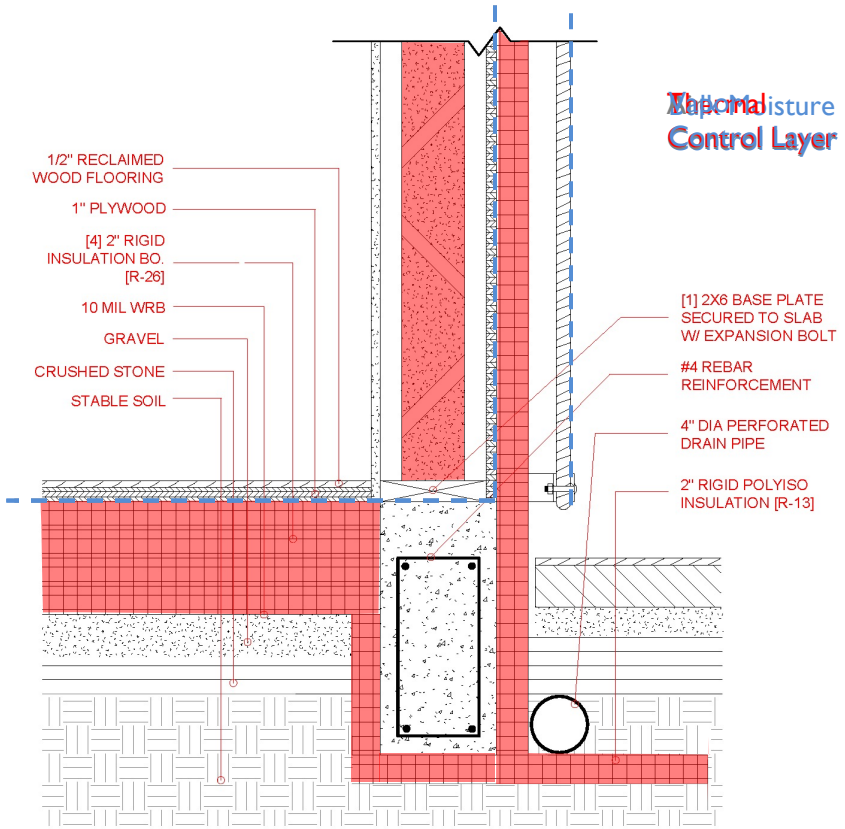
**Total Slab Concrete Savings = 6,649 CF**

**Overall Concrete Savings = 8,924 cf OR 88%**

### Foundation/Slab Section Detail



### Foundation Section Detail

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# ARCHITECTURE



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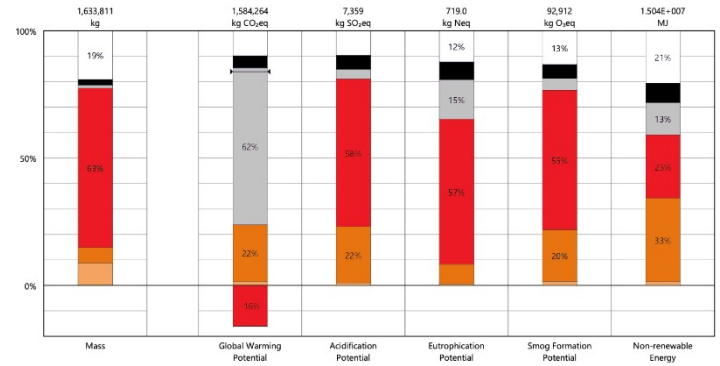
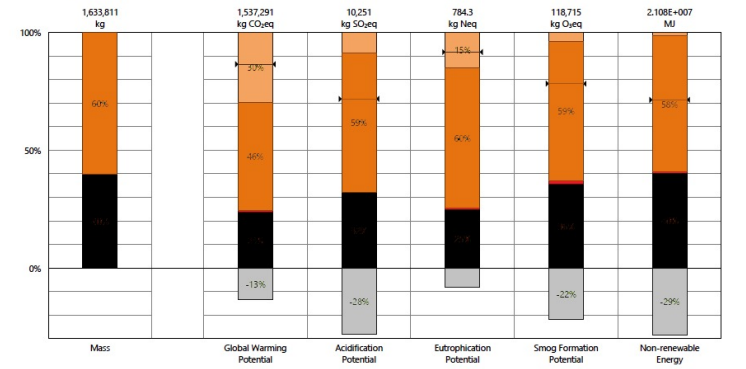
# ENVIRONMENTAL IMPACT



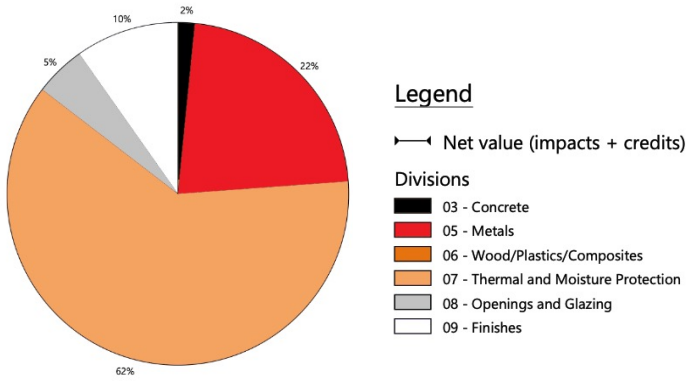
Results per Division



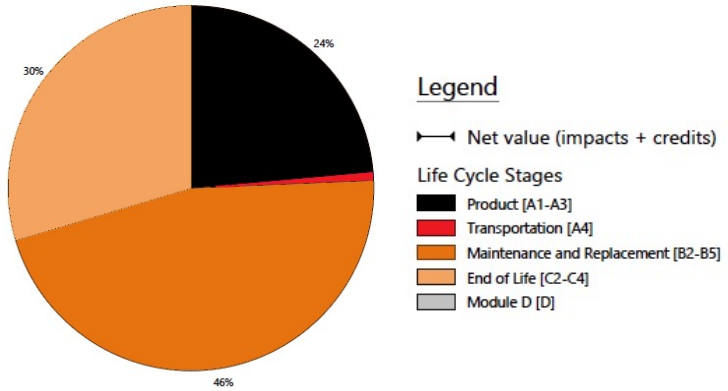

Results per Life Cycle Stage








Global Warming Potential




Global Warming Potential

MIDWEST

Concrete indy

NELMA

# ARCHITECTURE



# ARCHITECTURE




XERO
ONE
WAY